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**TRANSPORTING
PACKAGED FROZEN POULTRY
TO EUROPEAN MARKETS
IN VAN CONTAINERS
AND BREAK-BULK SHIPMENTS;**

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AN INTERIM REPORT

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U.S. DEPARTMENT OF AGRICULTURE

PREFACE

This is the first report of a study by ARS to find ways of shipping U.S. poultry to overseas markets at lower cost and in better condition.

Shippers, receivers, forwarders, carriers, and fiberboard box manufacturers helped make this study possible by furnishing materials, products, equipment, and facilities for the research. The Foreign Agricultural Service, USDA, and the Institute of American Poultry Industries assisted in the data gathering.

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TRANSPORTING PACKAGED FROZEN POULTRY TO
EUROPEAN MARKETS IN VAN CONTAINERS
AND BREAK-BULK SHIPMENTS

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SUMMARY

This is an interim report of research done in 1966, to study the performance of refrigerated van containers with the aim of reducing the cost of packaging, handling and transporting poultry to overseas markets.

The charges for shipping frozen poultry to European markets were slightly higher when van containers were used than when the product moved break bulk. But the results of test shipments of frozen poultry in van containers point toward these advantages for containerized shipments:

1. Maintaining the product at desirable temperatures from origin to destination.
2. More efficient transfer of cargo at ports.
3. Reduction in box damage and pilferage.

In the three paired test shipments, transport charges, fees, and labor costs ranged from 3.4 to 7.9 cents per pound for the van-container shipments and from 3.3 to 6.0 cents per pound for the break-bulk shipments. The transport charges, fees, and labor costs per pound averaged 6.4 cents for the van-container shipments and 4.9 cents for the break-bulk shipments.

For loading poultry at the poultry processing plants and moving it on and off ships, and for unloading it at the European receivers' warehouses in three paired shipments, labor costs were 0.1 cent per pound for movement in van containers and 0.7 cents per pound for movement in break-bulk shipments.

Fiberboard boxes of 200- and 250-pound test strength and strapped with only one steel band or no bands arrived in European markets in as good condition as fiberboard boxes of 275-pound test

strength strapped with two steel bands. By using the 200-pound test boxes without straps, costs of packaging materials and strapping could be reduced by 6.7 cents per box (0.1 cent per pound).

Break-bulk shipments were subject to pilferage when the boxes of poultry were handled individually in loading and unloading trucks and ships. There was no evidence of pilferage in any of the van container shipments.

The average air temperatures in the boxes, from the time they left the poultry processing plants until they arrived at the European receivers' warehouses, were -9° F. for those shipped in the van containers and 14° F. for those moved break bulk.

Shipping agricultural perishables by refrigerated van containers provides opportunities for reducing marketing costs. Such shipments can help cut costs of shipping to overseas markets by reducing transit times, costs of packaging, and number of handlings, and by protecting the product and boxes from mechanical damage, pilferage, and exposure to adverse environmental conditions.

The research conducted for this study was directed toward adapting van containers to the transport of frozen poultry. It drew preliminary comparisons between the van-container and break-bulk shipments aimed at reducing transport, handling, and packaging costs for overseas shipments of frozen poultry. This study also helped to develop methodology because the transport of frozen poultry to Europe by van-container service was just beginning when the research project was initiated. Instead of presenting conclusive results, this report directs attention to potential economies in shipping frozen poultry to overseas markets, and to areas needing further research and study.

INTRODUCTION

Exports of agricultural products are of major importance to U.S. agriculture and the U.S. balance of international payments. In 1966, 179 million pounds of U.S. poultry were marketed in a hundred foreign countries. Ninety-one million pounds of broilers, 12 million pounds of mature chickens, 47 million pounds of turkeys, and 29 million pounds of other poultry meat were marketed abroad. The value of these 1966 exports was \$60 million.^{1/}

^{1/} Institute of American Poultry Industries. Institute of American Poultry Industries: what it is, how it works, what it does. 16 pp., illus. (1966).

Improved agricultural technology has enabled European poultry producers to become more efficient and to provide quality and price competition. Also, their nearness to European markets gives them important advantages over U.S. producers. The most important of these advantages are lowered transport costs and decreased transport time. Moreover, U.S. poultry producers are disadvantaged because some of the frozen poultry they export to overseas markets in break bulk is subjected to multiple handlings and adverse climatic conditions. These are serious problems that add significantly to the cost of exporting U.S. frozen poultry.

TRANSPORT STUDIES

Procedure

Three paired tests of van-container and break-bulk shipments of frozen turkeys were made in 1966 (table 1). Each pair of shipments originated from the same poultry processing plant and was delivered to the same European receiver. One additional break-bulk test shipment and four additional van-container test shipments were made from various points in the United States to several European countries.

Temperatures of both the break-bulk and the van-container shipments were obtained from recording thermometers placed in the shipping containers. During loading, three boxes containing thermometers were placed in predetermined locations in the load. The thermometers were removed from the shipping boxes at the European receivers' warehouses.

Labor costs were based on measurement of time required for truck and ship loading and unloading operations and on wage rates paid by processors, warehouse operators, and stevedore companies. Inland and ocean transport charges were obtained from bills of lading and carriers' tariffs. Forwarding, insurance, and port charges were obtained from shippers and forwarders. Information on customs regulations was obtained from customs officials, forwarders, and receivers. Record was also made of the length of time required for loading, transporting, and unloading each shipment.

The condition of the poultry and the boxes was recorded at origin and upon arrival at port of embarkation and destination port, or at the receivers' warehouses.

Six receivers of test shipments were questioned about their reaction to van-container and break-bulk shipments. They also were questioned about damage and pilferage experiences, and problems encountered when importing U.S. poultry.

TABLE 1.--Test shipments of frozen poultry from U.S. to Europe, 1966

Test number and type of shipment	Product	Origin	Destination	Weight of poultry	Boxes
<u>Paired shipments</u>				<u>Pounds</u>	<u>Number</u>
1. Van container	Turkeys	North Carolina	Milan, Italy <u>1</u> /	26,969	633
Break bulk	Turkeys	North Carolina	Milan, Italy	25,576	694
2. Van container	Turkeys	Virginia	Hamburg, Germany	32,800	707
Break bulk	Turkeys	Virginia	Hamburg, Germany	31,487	707
3. Van container	Turkeys	Iowa <u>2</u> /	Milan, Italy <u>1</u> /	31,119	664
Break bulk	Turkeys	Iowa	Milan, Italy	25,763	574
<u>Single shipments</u>					
1. Van container	Chicken (parts, necks and backs)	Virginia	Hamburg, Germany	34,219	1,328
2. Van container	Chicken (parts, necks and backs)	Virginia	Hattingen, Germany	34,335	1,090
3. Van container	Turkeys	Virginia	Hamburg, Germany	30,970	718
4. Break bulk	Chickens (broilers)	Georgia	Athens, Greece	32,000	818
5. Van container	Turkey parts	Iowa	Rotterdam, Holland	33,000	1,000

1/ Van container hauled overland from Rotterdam to Milan by tractor truck.

2/ Trailer piggybacked to New Jersey and shipment transferred to van container for remainder of trip.

Description of Transport Handling and Refrigeration Systems

Handling

The handling and truck loading methods at the poultry processing plants were similar for both the break-bulk and the van-container shipments. The boxes were brought on pallets from the shippers' warehouses by forklift trucks to the truck loading docks. The boxes were then manually loaded in the trucks and van containers.

At the port the individual boxes in break-bulk shipments were handled three times, and as units on pallets they received two additional handlings while being transferred from the refrigerated trailer to the refrigerated hold of the ship. The boxes were stacked on pallets when they were unloaded from the trailer and were then transported to the outloading section of the pier warehouse, where they were temporarily stored. At loading time, the pallets were transported by forklift truck to shipside and deposited in the hold by ship's cargo sling. The boxes were then removed from the pallets and placed on a roller conveyor for transfer to the refrigerated hold.

On arrival at the overseas port, the loading process was reversed and five more handlings were required in unloading the boxes from the ship's hold and placing them on the inland delivery equipment.

All of the refrigerated van containers used in these shipping tests were of similar design and construction, with outside dimensions 8 feet 6 inches high, 8 feet wide, and 35 feet long. Inside, the vans were 7 feet 3 inches high, 7 feet 4 inches wide, and 32 feet 1 inch long--dimensions equivalent to 1,705 cubic feet. However, because of the space occupied by the refrigeration unit and by the ceiling air duct, which extended more than three-fourths of the length of the trailer, only 1,450 cubic feet could be used for the cargo.^{2/}

After loading, the individual van container was sealed at the processing plant and the poultry was not handled again until the seal was broken for customs inspection either at the border of the destination country or at the receiver's European warehouse.

The van container was removed from its chassis and loaded on the containership at the port of shipment and was unloaded at the overseas port and placed on an awaiting trailer chassis by either a ship-based gantry crane or a track-mounted dockside crane. The

^{2/} Sea-Land Service, Inc. Reefer operations manual. 77 pp., Elizabeth, N.J. 1965. (See Sect. 6, p. A-1.)

shore-based container crane was electrically operated by one operator and had a lift capacity of 27.5 tons. It could be operated at various heights, from 80 feet to 206 feet.^{3/}

Refrigeration Systems

Three of the break-bulk shipments were carried in refrigerated compartments located in the upper and lower between deck spaces of dry-cargo carrier ships. The other break-bulk shipment moved on a small (1300-ton), totally refrigerated, chartered cargo ship. The refrigerated compartments were cooled by air circulated over refrigeration coils in the ceiling. The air was discharged from blower outlets above the load and moved down the sidewalls and rear of the load before returning to the evaporator coils through the channels in the floor.

All of the refrigerated van containers were of conventional design, insulated with 3 inches of polyurethane insulation and with mechanical refrigerating units recessed into the front ends. The refrigerating units had cooling capacities of about 18,000 B.t.u.'s at 0° F. (7 tons), with temperature ranges of -15° to +60° F.

The electrically driven refrigeration units of the van containers could be powered from two sources: propane gas motor-driven generators or 440-volt electric currents introduced from outside the van. Propane-powered generators were used as power sources when the vans were transported over the road. During ocean transit, shipboard generators served as power sources. While the vans were on board ship, the air temperatures and the functioning of the refrigeration units were checked every 4 hours.

Arrival Condition

Break bulk

Only one of the break-bulk shipments arrived at destination in good order; the other three suffered a considerable amount of box damage (see figs. 1 and 2). The boxes were in disorder and many of them were partly crushed. Despite the box damage, however, the product was generally in good condition.

^{3/} New York Port Authority. New York port handbook. 224 pp., illus. New York. 1966. (See pp. 112-130.)



Figure 1.--Poultry boxes in ship's refrigerated hold after discharge of cargo at preceding port.

The truck loads and boxes arrived in good order at the port of embarkation. Most of the damage to the boxes occurred at the ports and other transfer points. Additional box damage was caused by the en route discharging of part of the cargo from the refrigerated holds--a practice that left the remainder of the cargo in disarray. The load conditions and stacking patterns on the European delivery vehicles were disorganized and the boxes suffered further damage during delivery. (Seventy percent of the boxes in one of the break-bulk shipments to Italy were damaged by the time it reached its destination.)

Van Containers

The arrival condition of the boxes and their contents in the van-container shipments was excellent. There was no shifting of boxes in transit and the stacking patterns remained intact (fig. 3).

Poultry Refrigeration

Frozen poultry should be maintained at temperatures ranging between 0 and -20° F. ^{4/} The temperatures in the van containers averaged -9° F. from origin to destination. These temperatures were much lower than those in the break-bulk shipments, which averaged 14° F. (fig. 4).

^{4/} American Society of Heating, Refrigerating and Air Conditioning Engineers. ASHRAE, guide and data book. 1023 pp., illus. New York. 1966-67. (See p. 640.)



Figure 2.--Boxes unloaded from break-bulk shipments at overseas ports.



Figure 3.--Boxes in van container at destination

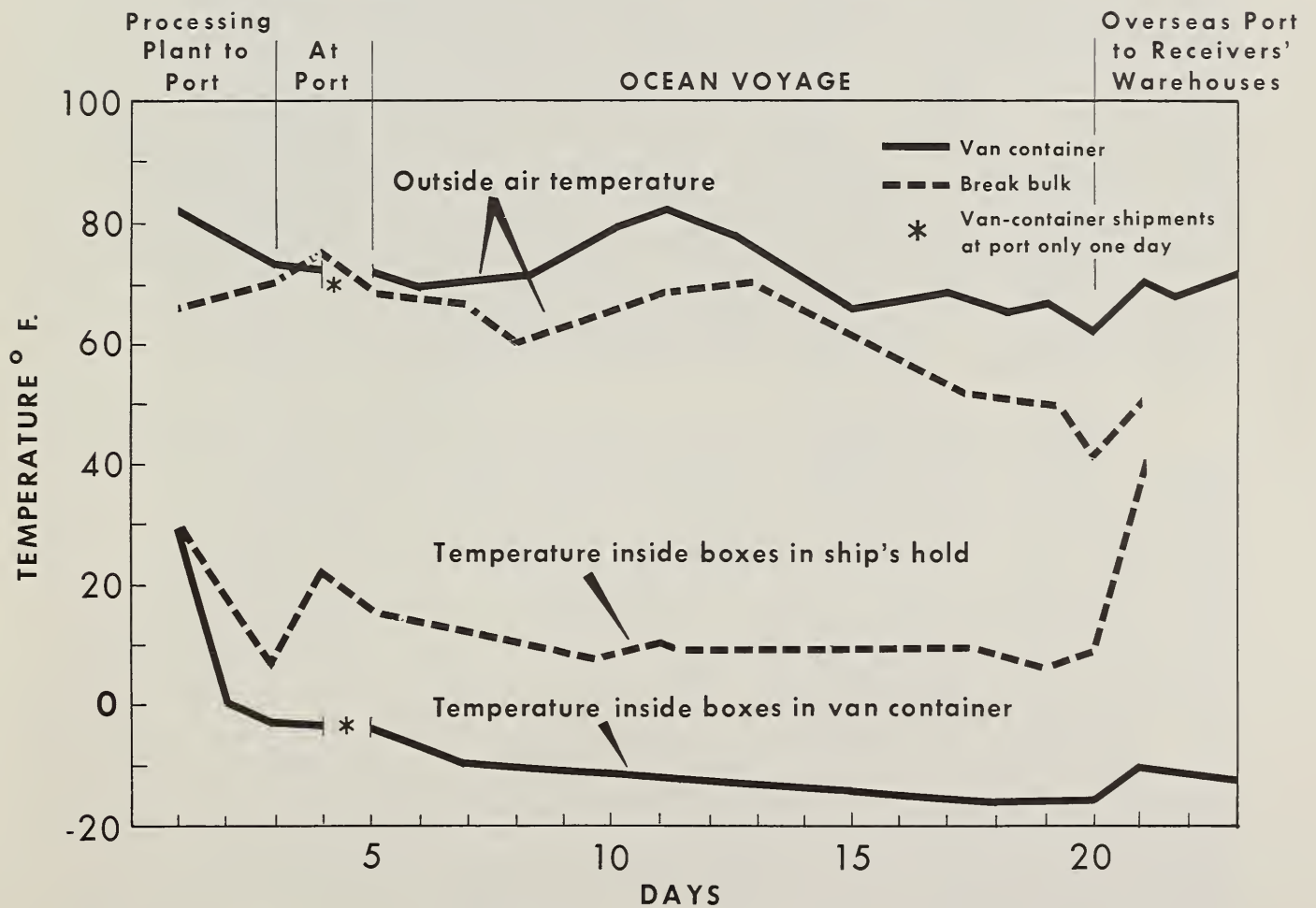


Figure 4.--Average temperature of outside air and average temperatures inside the boxes of three paired van-container and break-bulk shipments of frozen poultry.

The boxes in one of the break-bulk shipments were exposed to 90° F. outside air temperatures at the port of loading for an 8-hour period, from the time they were unloaded from the refrigerated trailer until they were put in the ship's hold. Of the four break-bulk shipments studied, none had refrigeration protection from the time it was unloaded from the ship until it was placed in the receiver's warehouse.

Transport Charges, Insurance and Forwarders' Fees, and Labor Costs and Productivity

Transport Charges

No great differences are discernible in the ocean transport charges for the van-container and the break-bulk shipments that went to European markets (table 2). Where differences do appear, they can be ascribed principally to the higher rates charged for the van-container shipments because the containership carrier was a member of the North Atlantic Continental Freight Conference. The carriers of the break-bulk shipments did not belong to the Conference and their rates were 10 to 20 percent below the Conference rates. There was some variation in the rates charged for the van-container shipments because one shipment (No. 2) received a 10-percent discount and one shipment (No. 3) received a 5-percent discount on the ocean transport rate. Since the latter part of 1966, van containers loaded by the shippers and delivered to the receivers for unloading have been entitled to a 10-percent discount. Test shipment No. 3 received only a 5-percent discount because, although it was unloaded by the receiver, it was loaded at the port instead of at the poultry processing plant.

Although the inland transport charges varied greatly, they were higher for the van-container shipments than for the break-bulk shipments. When the first test shipments were made, the only port facilities available for U.S.-Europe van-container traffic were New York in the United States and three ports in Northern Europe. The U.S. shippers were charged for hauling the empty van containers from the carrier's terminal to the processing plants and the European receivers were charged for hauling the poultry from the port of entry to their respective warehouses. For example, when paired shipment No. 1 was made, the charge for transporting a van container from New York to North Carolina and return was \$500. Three months after this shipment was made, container facilities were established in Baltimore and \$35 was charged for hauling an empty van container from the Port of Baltimore to Virginia and return. The charges for hauling the van container in paired test shipments Nos. 1 and 3 from Rotterdam overland by truck to Milan were \$610 per van container. At the time of these test shipments,

TABLE 2.--Transport charges for moving frozen poultry by break bulk and by van container from U.S. to Europe, 1966

Test shipment	Origin	Destination	Weight	Inland transport		Ocean		Inland transport		Total		
				charges to U.S.		transport		charges to		transport		
				port		charges		European receivers		charges		
				Total	Per pound	Total	Per pound	Total	Per pound	Total	Per pound	
				Pounds	Dollars	Cents	Dollars	Cents	Dollars	Cents	Dollars	Cents
1. Van container	N.C.	Italy	:26,969	:1/ 500.00:	1.9	:2/ 899.64:	3.4	:3/ 610.00:	2.3	:2,009.64:	7.6	
Break bulk	N.C.	Italy	:25,576	:4/ 300.00:	1.2	:5/ 970.52:	3.8	:6/ 69.80:	.3	:1,340.32:	5.3	
2. Van container	Va.	Germany	:32,800	:7/ 35.00:	.1	:8/ 984.91:	3.0	: (9/)	--	:1,019.91:	3.1	
Break bulk	Va.	Germany	:31,487	:7/ 35.00:	.1	:10/ 871.46:	2.8	:47.00:	.1	:953.46:	3.0	
3. Van container	Iowa	Italy	:30,119	:11/ 768.00:	2.5	:2/ 954.23:	3.2	:3/ 610.00:	2.0	:2,332.23:	7.7	
Break bulk	Iowa	Italy	:25,763	:12/ 415.61:	1.6	:5/ 977.61:	3.8	:6/ 96.66:	.4	:1,489.88:	5.8	

1/ Empty container trucked from New Jersey to North Carolina and loaded container returned to New Jersey.
2/ North Atlantic Continental Freight Conference rate from New York to Rotterdam.

3/ Represents truck charge from Rotterdam to Milan.

4/ Truck charge from North Carolina to New York.

5/ Non-Conference rate from New York to Genoa.

6/ Trucked from Genoa to Milan.

7/ Truck charge from Broadway, Va., to Baltimore. These charges are low because the trucks were used for backhaul of freight.

8/ Conference rate from Baltimore to Bremen.

9/ No charge because delivery was within port area.

10/ Non-Conference rate from Norfolk to Hamburg.

11/ Loaded trailer piggybacked to New York where load was transferred to a van container.

12/ Shipment hauled by truck from Iowa to New York.

no containership service was available to the Mediterranean and shipments Nos. 1 and 3 had to be routed through northern European ports. The break-bulk shipments in Nos. 1 and 3 were unloaded in Genoa and hauled to Milan by truck and rail.

Insurance and Forwarders' Fees

Insurance rates were not affected by the use of van containers. During the time the transport test shipments were made, insurance underwriters had not established a separate scale of rates for van container shipments because they lacked sufficient data on which to base such a scale. The owner of the containership carrier provided his own insurance on the cargo while it was in ocean transit. Most of the poultry was sold on a c.i.f. ("cost, insurance, and freight") basis. The shipper provided insurance protection from his warehouse to the U.S. port and from the overseas port to the receiver's warehouse. The cost for this insurance averaged about \$21 per van container. The receiver of the Italian shipments bought the product on an f.a.s. ("free alongside ship") basis and was self-insured. However, the use of van containers reduces the number of handlings from 12 to two and almost eliminates pilferage. Therefore, insurance rates are expected to be reduced.

U.S. forwarders' fees for both export and import were constant and amounted to almost \$16 per shipment. About 1 percent of the ocean bill-of-lading was charged by the forwarders in Europe. The forwarders both here and overseas arranged for and expedited the movement of the shipment from origin to destination.

Labor Costs and Productivity 5/

Labor costs averaged 0.7 cents per pound for the break-bulk paired test shipments and 0.1 cent per pound for the van-container shipments (table 3). However, the experimental nature of the tests caused considerable variation in the amount of labor used to load the van containers and trucks at the processing plants and to handle and unload them at the ports and receivers' warehouses. More labor was used to load van containers than truck trailers at the poultry processing plants, but less labor was used to unload the van containers at the destination warehouses.

5/ For purposes of this study, labor productivity is defined as the pounds of poultry handled per man-hour.

TABLE 3.--Labor costs and labor productivity^{1/} for handling frozen poultry transported by break bulk and by van container from U.S. to Europe, 1966

Test shipment	Origin	Destination	Weight	Poultry processing plant				Embarkation port			
				Handling	Poultry	Cost per	Handling	Handling	Poultry	Cost per	
				time	handled per:	pound	time	time	handled per:	pound	
					man-hour				man-hour		
			Pounds	Man-hours	Pounds	Cents	Man-hours		Pounds		Cents
1. Van container	N.C.	Italy	26,969	14.00	1,880	0.08	2/ 1.50		17,551		0.02
Break bulk	N.C.	Italy	25,576	10.00	2,558	.05	3/ 45.00		568		.55
2. Van container	Va.	Germany	32,800	10.25	3,200	.04	2/ 1.50		21,867		.01
Break bulk	Va.	Germany	31,478	11.50	2,738	.03	16.00		1,968		.14
3. Van container	Iowa	Italy	30,119	10.25	2,938	.03	4/ 7.75		3,886		.05
Break bulk	Iowa	Italy	25,763	5.50	4,684	.04	23.75		1,085		.39
<hr/>											
Debarcation port				Destination				Total			
Handling	Poultry	Cost per:	Handling	Poultry	Cost per:	Handling	time	Handling	Poultry	Cost per	
time	handled per:	pound	time	handled per:	pound	time		time	handled per:	pound	
	man-hour			man-hour					man-hour		
		Pounds	Man-hours	Pounds	Cents	Man-hours		Man-hours	Pounds	Cents	
1. Van container	2/ 1.50	17,551	0.02	13.50	1,950	0.05	30.50		863		0.17
Break bulk	3/ 114.00	224	.32	16.00	1,598	.04	185.00		138		.96
2. Van container	2/ 1.50	21,867	.01	10.00	3,280	.02	23.25		1,411		.08
Break bulk	67.00	470	.25	14.00	2,249	.07	108.50		290		.48
3. Van container	2/ 1.50	20,079	.02	12.00	2,510	.02	31.75		946		.12
Break bulk	5/ 99.00	260	.24	15.00	1,718	.04	143.25		180		.71

^{1/} Labor productivity is based on pounds of poultry handled per man-hour. ^{2/} Based on a sample number of observations of loading and unloading van containers on and off ships. A crew of 18 men required an average of 5 minutes per van container. ^{3/} Frequent interruptions occurred in loading and unloading operations. ^{4/} Poultry was transferred from a piggyback trailer (chassis attached) to a van container at the port of embarkation. ^{6 1/2} man-hours were required to load the poultry in the van container and ^{1 1/2} man-hours were required to load the van container on the ship. ^{5/} Unloading delayed because of rain.

Labor productivity was much greater when van containers loaded with poultry were conveyed on and off ships than when separate boxes of poultry were unloaded from trucks to piers, loaded in ships' holds, and unloaded again at ports of debarkation. A crew of 18 workers was able to move a loaded van container on or off a ship in 5 minutes, but it took an equivalent-sized crew 1 1/2 hours to load the same amount of poultry in break-bulk ships. Unloading the break-bulk shipments, particularly when the cargo was discharged at many ports, took longer than loading them.

Test results showed labor productivity was 19,832 pounds per man-hour for loading and unloading van containers on and off ship, and 1,207 for loading and 318 for unloading break-bulk ships. This great difference in labor productivity is offset to some degree by capital investments in van containers, port facilities, and related equipment.

Summary

The transport charges, labor costs, fees, and insurance for each of the paired test shipments are shown in table 4. In the paired test shipments, the transport charges, fees, and labor costs averaged 6.4 cents for the van-container shipments and 4.9 cents for the break-bulk shipments. Individual costs and charges varied greatly. Despite the higher current charges, shipping by van container should become more efficient and the charges for moving United States products to overseas markets should be reduced. As additional ports in the United States and southern Europe establish container facilities, inland transport costs will be reduced. As container facilities expand, port transfer should become more efficient. A containership can be loaded and unloaded in 12 to 24 hours instead of the 4 to 6 days required to load and unload a conventional cargo ship. This faster loading and unloading leads to greater efficiency in the use of ships and port facilities. Previous research has shown that about half of the ocean carriers' transport expenses are incurred at ports and terminals.^{6/}

Pilferage

Researchers observed pilfering in the break-bulk shipments but saw no evidence of pilferage in the van-container shipments.

^{6/} United Nations Department of Economic and Government Affairs. An examination of some aspects of the unit-load system of cargo shipments: application to developing countries. Sales No. 66. VIII.2. 96 pp., illus. 1966. (See p. 33.)

TABLE 4.--Labor cost, fees and insurance, and transport charges for shipping frozen poultry by break bulk and by van container, U.S. to Europe, 1966

Test shipment	Origin	Destination	Weight	Labor cost for loading at plant	Forwarders' fees and insurance	Transport charges to U.S. port	Ocean transport charges	Inland transport charges	Labor costs for unloading at destination	Labor costs, fees and transport charges
			Pounds	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars and Cents
<u>PAIRED SHIPMENTS</u>										
1. Van container	N.C.	Italy	26,969	19.80	36.50	4/ 500.00	5/899.64	6/610.00	14.38	2,080.32
Break bulk	N.C.	Italy	25,576	12.50	31.00	7/ 300.00	8/970.52	9/ 69.80	9.77	1,393.59
2. Van container	Va.	Germany	32,800	14.04	62.50	10/ 35.00	11/984.91	12/ --	7.50	1,103.95
Break bulk	Va.	Germany	31,487	10.96	41.50	13/ 35.00	14/871.46	47.00	20.58	1,026.50
3. Van container	Iowa	Italy	30,119	9.70	36.50	15/ 768.00	5/954.23	6/610.00	7.20	2,385.63
Break bulk	Iowa	Italy	25,763	9.20	31.50	7/ 415.61	8/977.61	9/ 96.66	9.38	1,539.96
<u>SINGLE SHIPMENTS</u>										
1. Van container	Va.	Germany	34,219	13.05	50.50	4/ 350.00	11/907.20	12/ --	10.00	1,330.75
2. Van container	Va.	Germany	34,335	4.11	62.00	4/ 350.00	11/871.56	16/115.00	4.95	1,407.62
3. Van container	Va.	Germany	30,970	8.22	62.50	10/ 35.00	17/929.75	12/ --	7.50	1,042.97
4. Break bulk	Ga.	Greece	32,000	8.18	50.94	18/ 225.00	19/1,283.25	32.00	15.68	1,615.05
5. Van container	Iowa	Nether-lands	33,000	9.70	57.80	20/ 716.00	5/816.71	52.90	17.38	1,670.49

1/ Van container charges include cost of bringing empty van container from carrier terminal to processing plant.

2/ Include costs of labor for loading and unloading ships either break bulk or in van containers.

3/ Delivery within port area except where noted.

4/ Motor carrier picked up empty van container and delivered loaded container to Port of New York.

5/ North Atlantic Continental Freight Conference rate from New York to Rotterdam.

6/ Containers hauled overland by truck from Rotterdam to Milan.

7/ Truck charge from origin to New York.

8/ Non-Conference rates charged--New York to Genoa.

9/ Charges from Genoa to Milan.

10/ Shipper's tractor picked up and delivered van container to Port of Baltimore.

11/ Conference rate--New York to Bremen.

12/ No charge because delivery was within port area.

13/ Shipper's tractor-trailer delivered shipment to port of Norfolk.

14/ Non-Conference rate--Norfolk to Hamburg.

15/ Product shipped by piggyback trailer to New York and transferred to a van container.

16/ Delivery to Hattingen (Germany).

17/ Conference rate--Baltimore to Bremen.

18/ Truck charge from Atlanta to port of Charleston.

19/ Charges based on ship charter--Charleston to Athens.

20/ Product loaded in van container and shipped by piggyback to New York.

Because there was usually no external evidence of pilfering when one or more birds were removed from occasional boxes, the researchers were unable to record accurately the exact amount of pilferage. Inquiries concerning statistics reveal that because of the time and effort required to record such data, the shippers and receivers questioned did not maintain records on pilferage losses. Shippers and receivers of break-bulk shipments estimated that pilferage ranged from 1/2 to 1 percent of the poultry handled.

Transit Time

The transit times listed in table 5 show no important differences between the break-bulk and the van-container shipments. Seven of the shipments were made during November and three of these were delayed by storms at sea. Another cause of increased transit time was delay in the inland transportation caused in part by poor coordination in transport schedules between the inland and the ocean carriers.

Two of the break-bulk shipments were transported on fast (20-knot an hour) ships, although one was detained for 2 days because it had stopped to discharge cargo at Rotterdam. One break-bulk shipment to Italy was delayed 2 days by discharge of cargo in Barcelona and still another--to Greece--was transported by a small (1,300-ton), refrigerated, chartered ship that averaged only 14 knots an hour.

Load Density in the Van Containers

To make efficient use of the space and weight capabilities of the van containers used in the tests, load densities of 21.6 pounds per cubic foot were required.^{7/} The load density was greater for two shipments, about the same for one shipment, and less than 21.6 pounds per cubic foot for two shipments (table 6).

PACKAGING TESTS IN VAN-CONTAINER SHIPMENTS

Procedure

Three fiberboard shipping boxes were studied: a box constructed of 275-pound test-strength corrugated board, already in general use, and two experimental boxes constructed of lighter (250- and 200-pound)

^{7/} Sea-Land Service, Inc. An economic analysis of the 35-foot container. 77 pp., illus. 1967.(See Sect. III, p. 18.)

TABLE 5.--Transit time profiles for frozen poultry transported from U.S. to European markets, 1966

Test shipment	Origin	Destination	Transport: to port	embarkation: crossing	Ocean :At port of :Transport to:	Days	Days	Days	Days	Days	Days
<u>Paired shipments</u>											
1. Van container	N.C.	Italy	0.5	1	1/	17	2	2/	2	22.5	
Break bulk	N.C.	Italy	3	1	13	13	1	3/	2	20	
2. Van container	Va.	Germany	.5	3	12	12	1	1	1	17.5	
Break bulk	Va.	Germany	.5	4/	7	13	1	1	1	22.5	
3. Van container	Iowa	Italy	5/6	1	6/	15	1	2/	3	26	
Break bulk	Iowa	Italy	2	1	13	13	7/	4	1	21	
<u>Single shipments</u>											
1. Van container	Va.	Germany	1	1	11	11	1	1	1	15	
2. Van container	Va.	Germany	.5	1	10	10	1.5	.5	.5	13.5	
3. Van container	Va.	Germany	.5	1	12	12	.5	.5	.5	14.5	
4. Break bulk	Ga.	Greece	.5	2	18	18	3	(8/)		23.5	
5. Van container	Iowa	Netherlands	5/11.	3	10	10	2	1	1	27	

1/ Ship delayed 3 days by mechanical difficulties.
2/ Highway transport from Rotterdam to Milan.
3/ Rail transport from Genoa to Milan.
4/ Ship detained at port awaiting cargo.

5/ Trailer piggybacked to port, load transferred to container van.
6/ 4-day delay because of rough seas.
7/ 3-day delay because of rain.
8/ Delivery in port area.

TABLE 6.--Load densities used in transporting frozen turkeys in van containers

Contents per box	Outside box dimensions	Boxes used : per load	Gross weight : of load <u>1/</u>	Load density <u>2/3/</u>
	<u>Inches</u>	<u>Number</u>	<u>Pounds</u>	<u>Pounds per cubic foot</u>
Turkey parts	25 3/4 x 13 x 7	1,000	33,000	22.8
6 turkeys, 6 to 8 lb. each	26 x 21 1/2 x 7	700	32,800	22.6
6 turkeys, 8 to 10 lb. each	26 x 21 1/2 x 7	718	30,970	21.4
2 turkeys, 20 to 24 lb. each	19 x 16 1/2 x 9 1/2	633	26,969	18.2
2 turkeys, 24 to 26 lb. each	19 x 16 1/2 x 9 1/2	664	30,119	20.8

1/ Includes weight of poultry in boxes.

2/ Usable van container capacity is 1,450 cubic feet.

3/ Gross weight of shipment divided by 1,450 cubic feet.

test strength board. The suitability and the strapping requirements of each were tested in three van-container shipments that originated in Virginia and terminated in West Germany. Each shipment contained six of each type of box selected for study. For testing purposes, half of the boxes of each type were strapped with two 3/8-inch-wide metal bands and the other half were shipped without bands.

The test boxes were placed in the last stack in the rear of the van containers--a position subject to severe shocks. The rest of the space in the van containers was loaded with conventional shipping boxes of 275-pound test strength board. For the first test, each box was secured with two steel bands. For the last two tests, each box was strapped with one steel band, secured lengthwise.

Upon arrival at their overseas destination, the test boxes, the turkeys, and the heat-shrinkable polyethylene bags in which the turkeys were enclosed were examined for damage. In addition, the three receivers of the test shipments were questioned about the suitability of the boxes and about strapping needs. Costs of the boxes and strapping materials were obtained from manufacturers and processors. Direct labor requirements for strapping were obtained by making time studies of specific operations. (Labor requirements and costs of box assembly, packing, and handling were presumed to be the same for each of the three types of fiberboard boxes tested.)

Description of Boxes

The shipping box commonly used for shipping 7- to 9-pound turkeys by break bulk is a full-telescope fiberboard box constructed of 275-pound test-strength corrugated board 8/ with inside dimensions measuring 24-1/2 by 19-1/2 by 7 inches. Corrugated fiberboard partitions divide the box into three compartments: two turkeys, each in a polyethylene bag, are packed in each compartment. Two 3/8-inch-wide steel straps are usually bound around each box, one strap lengthwise and one strap crosswise. Approximately 10 feet of steel strap per box is used for this purpose. The ends of the straps are welded together. (When one steel strap is used, it is placed lengthwise on the box to discourage pilferage.) One steel strap requires about 6.5 feet of strapping material per box.

The two experimental boxes were identical in size and design to the 275-pound test-strength fiberboard box except that one was constructed of 250-pound test-strength fiberboard and the other was constructed of 200-pound test-strength fiberboard.

8/ Bursting strength of fiberboard is expressed in pounds per square inch, as determined by the Mullen or Cady test.

Costs of Boxes and Strapping

The full-telescope fiberboard box (including cell partitions) constructed of 275-pound test-strength board costs 42 cents a box. The two experimental full-telescope fiberboard boxes (including cell partitions) constructed of 250- and 200-pound test-strength boards cost 40 and 38.2 cents a box, respectively.

The direct labor requirements for applying one or two steel straps per box are 0.821 man-minutes and 0.939 man-minutes, (table 7). At an average wage rate of \$2 per hour and including the cost of the steel straps, the estimated costs for applying one and two straps are 2.8 and 3.2 cents per box. The materials cost of the 275-pound fiberboard box with two straps, plus the strapping labor, was 45.2 cents. The potential savings in materials cost from use of lighter strength fiberboard or elimination of one or both straps is shown in table 8. The greatest savings, 6.7 cents per box, can be achieved by using 200-pound test-strength boxes without straps. However, some buyers may specify the use of one strap (see Trade Reaction). The use of one strap reduces the potential saving to 3.9 cents per box.

Arrival Condition of Turkeys, Bags, and Boxes

The turkeys arrived in excellent condition in all types of fiberboard boxes.

The percentage of heat-shrinkable polyethylene bags damaged,^{9/} by type of box, is shown below:

	<u>Slight</u>	<u>Serious</u>
275-lb. test-strength box	14.8	0.9
250-lb. test-strength box	15.7	0
200-lb. test-strength box	17.6	0

Injury to most of the slightly damaged bags consisted of small punctures caused by the wing joints of the turkey wings. Only one bag received a tear greater than 1/2 inch in length--this particular bag had a tear one inch long where it contacted one wing joint of the bird.

Except for minor cuts caused by the steel straps, none of the boxes in the three test shipments were damaged. The 200- and 250-pound test-strength fiberboard boxes did not show more strapping damage than the 275-pound test-strength fiberboard box.

^{9/} Slightly damaged bag was any bag with a tear or puncture less than 1/2 inch in length or diameter. Seriously damaged bag was any bag with tear more than 1/2 inch in length.

TABLE 7.--Labor requirements and labor and material costs^{1/} for applying metal straps to fiberboard shipping boxes^{2/} at one Virginia plant, 1966.

Item	Applying one		Applying two	
	metal strap		metal straps	
	Labor	Costs	Labor	Costs
	<u>Man-minute</u>	<u>Cents</u>	<u>Man-minute</u>	<u>Cents</u>
Move pallets from storage	0.117	0.39	0.117	0.39
Place boxes on conveyor	.235	.78	.235	.78
Operate semiautomatic strapping machine	.117	.39	.235	.78
Remove boxes from conveyor and place on pallets	.235	.78	.235	.78
Move pallets to storage or loading dock	.117	.39	.117	.39
Total labor requirements and costs per box	.821	2.73	.939	3.12
Strapping materials cost per box ^{3/}	--	.02	--	.04
Total cost per box	--	2.75	--	3.16

^{1/} Does not include cost of equipment, supervision, insurance, taxes, and other overhead. Includes 15-percent allowance for fatigue and personal time. Labor costs are calculated at an average wage rate of \$2 per hour.

^{2/} Full-telescope boxes with inside dimensions of 24½ by 19½ by 7 inches.

^{3/} Includes 15-percent allowance for strap waste.

TABLE 8.--Costs of fiberboard poultry boxes and strapping labor and materials, and potential savings from eliminating one or both straps or from using lighter strength materials, 1966.

Container	:	Cost of boxes and strapping	:	Savings <u>1/</u>
	:	<u>Cents</u>	:	<u>Cents</u>
275-lb. box <u>2/</u>	:		:	
No strap	:	42.0	:	3.2
1 strap	:	44.8	:	.4
2 straps	:	45.2	:	0
250-lb. box <u>2/</u>	:		:	
No strap	:	40.0	:	5.2
1 strap	:	42.8	:	2.4
2 straps	:	43.2	:	2.0
200-lb. box <u>2/</u>	:		:	
No strap	:	38.5	:	6.7
1 strap	:	41.3	:	3.9
2 straps	:	41.7	:	3.5

1/ Difference between cost of experimental boxes with one or no straps and cost of the 275-lb. test box with two straps.

2/ Boxes constructed of 275-, 250-, and 200-lb. test strength corrugated board.

Trade Reaction

Three receivers of van container shipments stated that the boxes with test strengths of 250 and 200 pounds would be satisfactory for storage and further distribution, provided they were transported in van containers directly to the receivers' warehouses. One receiver stated that box strapping was not necessary. This receiver's business was small and he distributed locally. Two receivers stated that box strapping was essential, but that one strap was enough to discourage pilfering.

CUSTOMS REGULATIONS AND DOCUMENTATION

The van-container shipments encountered few difficulties in customs clearance at the ports or at border crossings in transit. The European countries through which the shipments moved are members of the 1959 Customs Container Convention, which created TIR (Transport International Router). TIR allows temporary duty-free entry of containers

for a period not to exceed 3 months.^{10/} The two van-container shipments to Italy entered through the Port of Rotterdam where there was no delay and the only documentation papers required were (1) a certificate of nonmanipulation, (2) a customs declaration, and (3) a TIR Carnet, declaration of import presented by the receiver's forwarder. The van containers moved unimpeded from the Netherlands through Germany and Austria to the Italian border, where the container seal was broken by customs officials and the contents of one of the boxes were examined briefly. The customs inspection, by previous arrangement, was performed at the receiver's warehouse where import duties of \$6.35 per 100 pounds and an additional 5 percent of the import duty were assessed.

The following documentation was required for this final clearance before release of the shipment to the receivers:

- (1) A certificate of nonmanipulation
- (2) A copy of the shipment invoice
- (3) USDA Form PY 506, Export Certificate
- (4) Original bill-of-lading
- (5) A certificate of origin
- (6) USDA PY 224, Grading Certificate
- (7) A bank payment order

Three of the van-container shipments to Germany were unloaded at Bremen and moved to the receiver's warehouse in Hamburg with minimum delay. The receiver's import forwarders obtained immediate release of the containers with the presentation of the invoice and the certificate of origin. The forwarders also made arrangements to have the customs inspection performed and the duty paid at the receiver's warehouse. The duty amounted to \$23.93 per 100 pounds of turkeys and a sales tax of 4 percent of the invoiced value of the shipment. In addition to the payment of the duty, the following documents were required for customs clearance:

- (1) A bill-of-lading
- (2) USDA Form PY 506, Export Certificate
- (3) A certificate of origin
- (4) A bill-of-sale

^{10/} On March 1, 1967, the Senate of the United States gave final approval to the Customs Convention of Containers, making the United States a contracting party to the convention.

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